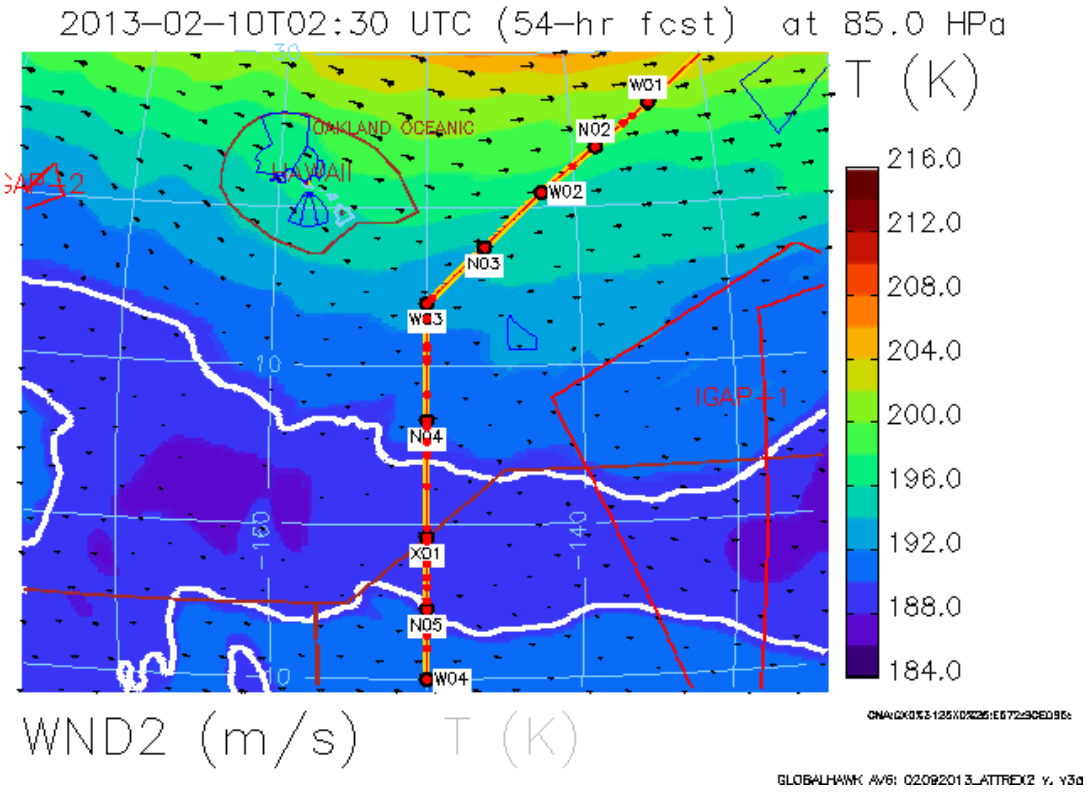
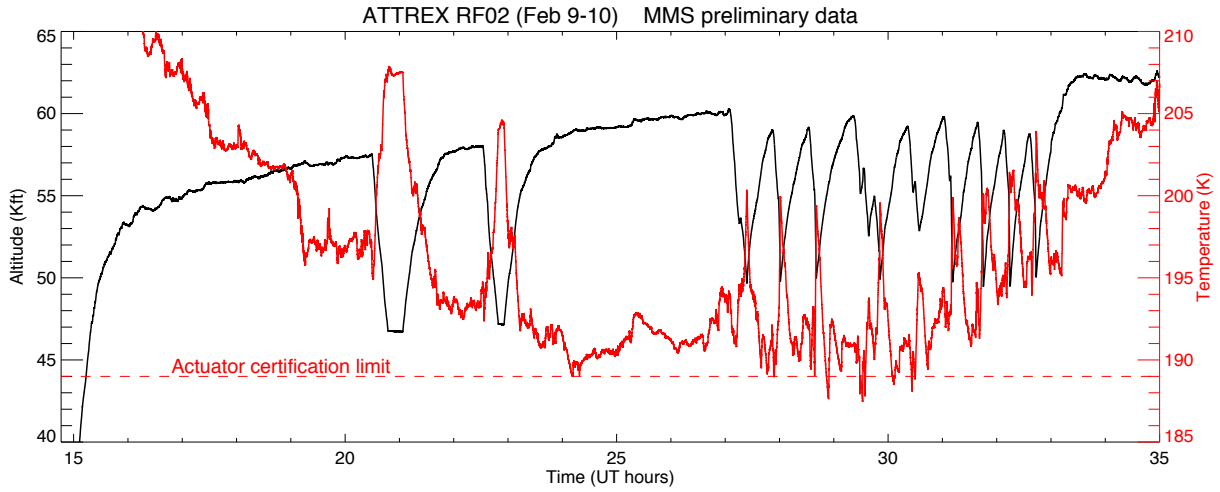
ATTREX Science Flight Report
2013-02-09 Science Flight #2
Takeoff: 1445 UT (0645 local), landing: 1503 (0703 following day), duration: 24.3 hours
Mission Scientists: Paul Newman, Eric Jensen, Hanwant Singh
Payload Managers: Erin Czech, Dave Jordan, Michael Craig

Summary:
This flight provided numerous vertical profiles through the TTL in the deep tropics (10 S to 20 N). Extremely dry air was sampled in the upper TTL. Air masses advected from the southern Pacific convergence zone and the western Pacific were sampled. Very low ozone concentrations were measured indicative of recent transport of clean air from the marine boundary layer to the uppermost troposphere by deep convection in the SPCZ. Ice clouds were detected near 5-10 N, but not in the upper TTL associated with the very dry layers. The southernmost flight leg extended down to about 12.5 N at 150 W.

The flight profile is shown below. Real-time CPL data was used to search for clouds in the TTL on the southbound leg through the tropics.



The altitude and temperature time series (preliminary data from MMS) for the flight are shown below.



Flight Log:

This is the 2nd science flight of AV-6 for ATTREX

1310 Engine start

1315 Hydraulic leak noted near nose gear, engines shut down. Plan is to cycle the "hike" a few times and re-assess

1349 Problem resolved, engines started.

1352 Preparing to power-up instruments. Lots of Iridium drop-outs.

1418 Bringing payload up

1436 Begin Taxi

1446 Takeoff

1455 Reached flight level FL270

1521 Passing FL480, 30 m/s W wind. MTP suggests interesting tropopause structure.

1527 Excellent winds ~40 m/s westerlies at FL500

1528 Apparent failure of GWAS during wide turn as we were exiting the range. 26 V breaker on the instrument seemed to have popped.

1547 After a couple of power cycles, GWAS is a hard failure.

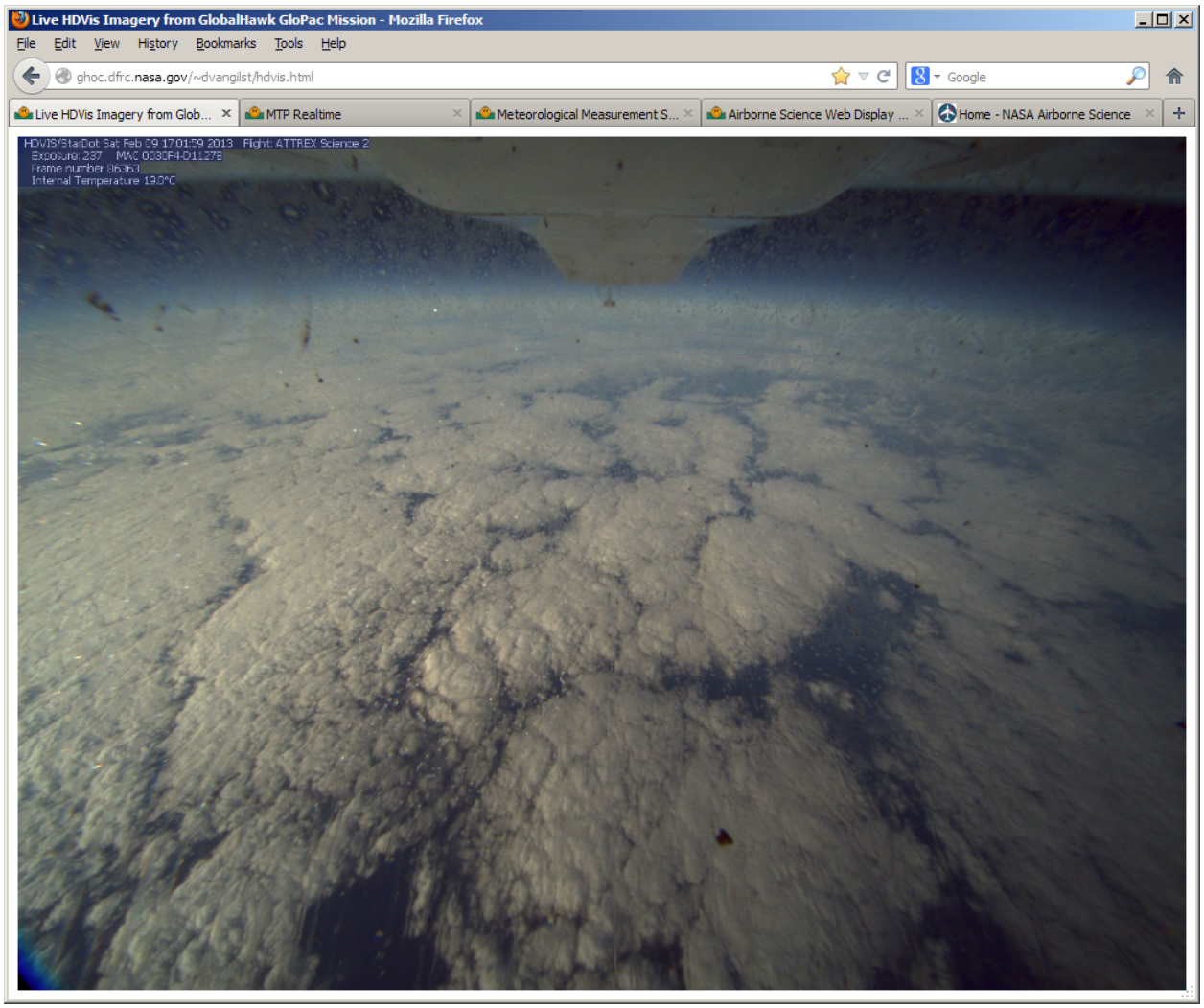
1547 Feet wet over the Pacific.

1618 Instrument Poll

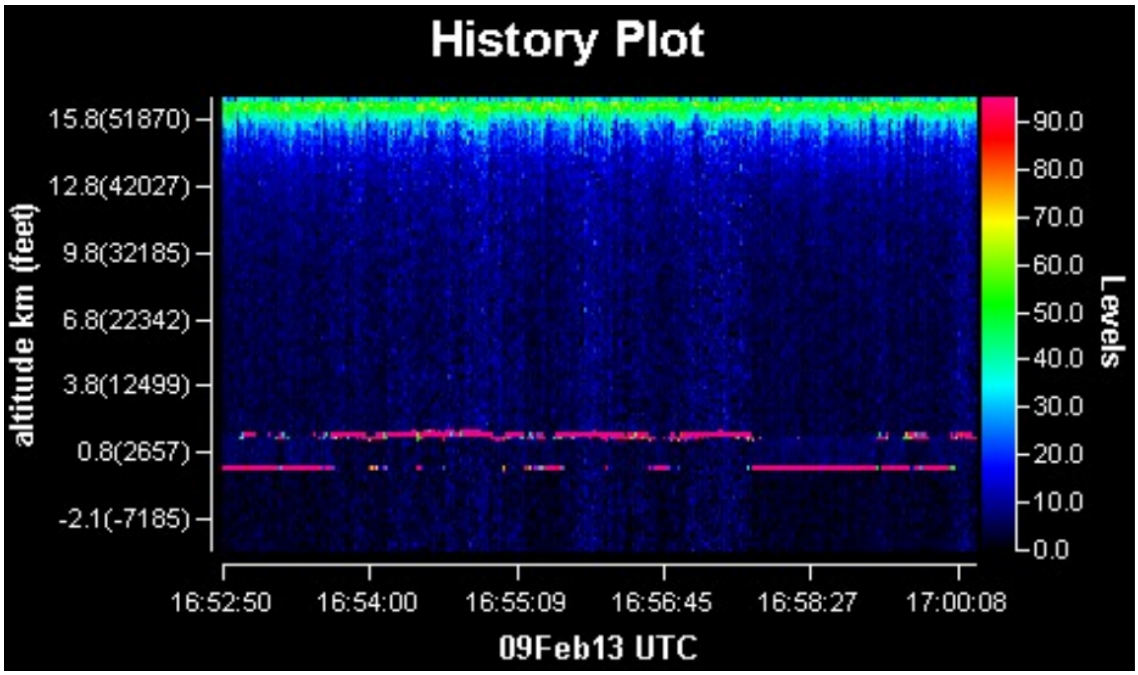
1. UCATS, WV, O3 – Good status. “old” O3 noisy at start, but cleaned up. Would desire 5 min. at bottom of dive
2. DLH – Working well. No preference on time at the bottom of the dive.
3. Mini-DOAS – Working well. Desirable to have 7 min. at bottom of dive.
4. FCDP – Working well, no preference on time at the bottom of the dive.
5. NOAA O3, WV – water is good, ozone is off by a factor of 3 because of “on-the-fly” estimates (subsequently fixed at 1640 UT). Data looks good. No preference on time at bottom of dive. Prefer we go all of the way. Would like at least one cal sequence at the bottom of the dive for WV.
6. SSFR – Working well. no preference on time at the bottom of the dive.
7. GWAS – hard failure. No data.
8. CPL – Good profile (1639 UT)
9. MMS – MMS doing pretty good. Added “angle-of-attack” to plot.
10. MTP – Doing well. Need less than 1-minute at bottom of profile
11. HU/PCRS – Doing fine. Would like to maximize dips and 5 minute at bottom.

1639 CPL cleared to lase after passing

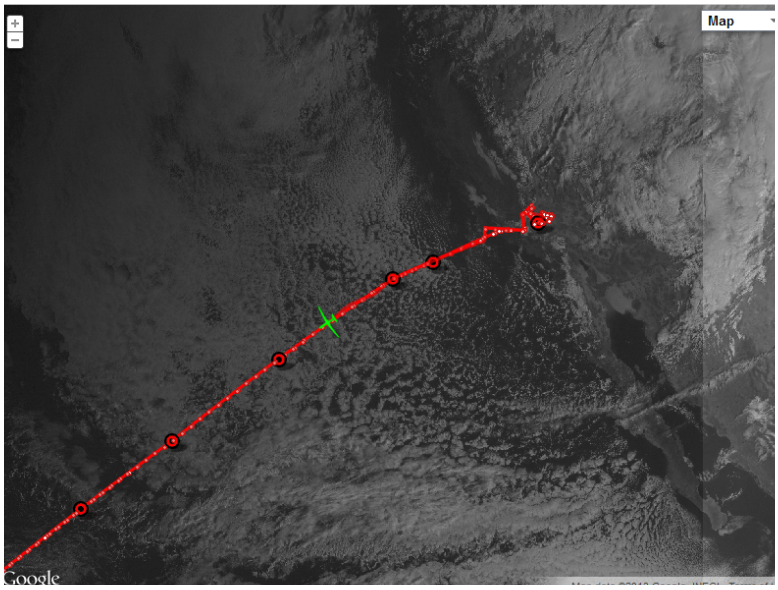
1701 Overflying low level marine stratus (about 3000 feet). HDVis showing this “spotty” stuff below the plane



1704 CPL shows this stuff at about 3000 feet.



1706 GOES vis imagery shows the same stuff.



1805 about 1km below cold point according to MTP. This is generally consistent with the decreased levels of ozone (~200 ppb). Whater is still low at about 2.5 ppm. If MTP is to be believed, trop is about 205 K.

1810 Rushan Gao noted some interesting variation in their flow. Suggests some turbulence or wave effects. MMS does not really show any funny behavior.

1822 CPL seeing some cirrus at 9 km.

2003 Flight proceeding normally.

2024 Starting descent sequence by powering down the laser. Ku disabled.

2029 Descent started. Not using spoilers.

2047 Dive bottomed out. 10 minute hold. 52 m/s wind at bottom of dive.

2056 Newman going off shift, Jensen takes over.

2103 Began ascent back to cruise altitude

2155 Still steaming SW at ~56.7 kft.

2155 Water vapor steady at about 2.5 ppmv; O3 at about 150 ppbv.

2230 Turning south and descending.

2251 At 45 kft, Ku back up.

2254 FCDP detecting ice crystals and NOAA sees condensed water.

2255 Climbing back up to cruise altitude.

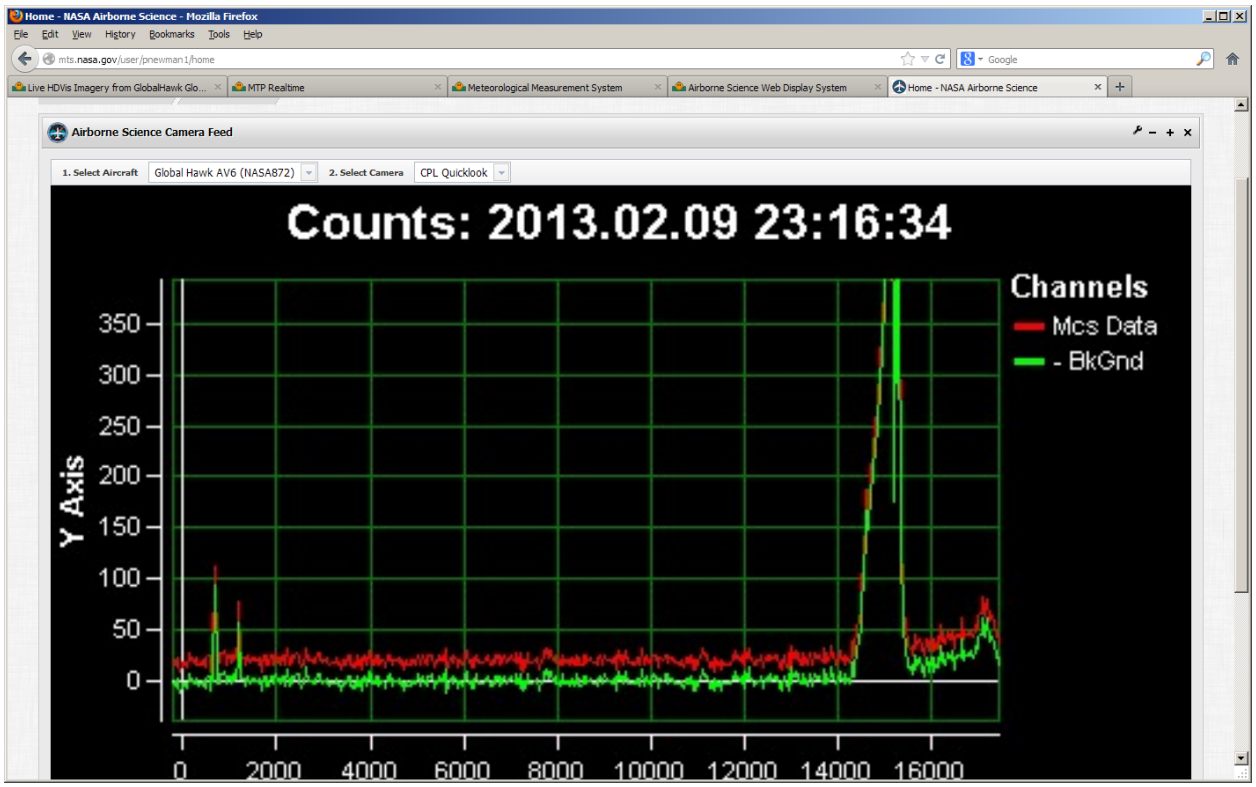
2300 Instrument Poll

1. UCATS, WV, O3 – All doing well.
2. DLH – Working well.
3. Mini-DOAS – Working well. Saw nice cirrus signals.
4. FCDP – Working well.
5. NOAA O3, WV – water and O3 are doing well. Total water still detecting ice on climb.
6. SSFR – Working well.
7. GWAS – hard failure. No data.
8. CPL – Good profile (1639 UT)
9. MMS – MMS doing pretty good. Added “angle-of-attack” to plot.
10. MTP – Doing well. Need less than 1-minute at bottom of profile
11. HU/PCRS – Doing “pretty good” (sic).

2311 We appear to have driven out of Ku coverage.

2313 Still seeing lots of total water at 53.8 Kft.

2317 CPL single-shot profile through Iridium:



2324 Cold point above aircraft approaching 189 K.

2325 CPL reports we're beyond the cirrus layer.

2335 Chuck Bardeen in the science seat

2342 CPL hasn't seen iridium packets in 7-8 minutes

2344 Data indicates they have seen some CPL packets, so CPL is checking to see if there could be a software problem.

2355 Reset CPL software and the problem seems to have cleared. Seeing profiles again.

0003 MTP indicates we are above the coldpoint, and coldest temperatures are in the 189-191 K range.

0010 -94 F TAT reached and declared. Pilots are aware and considering options.

0012 Temperature dropped back below -94 F

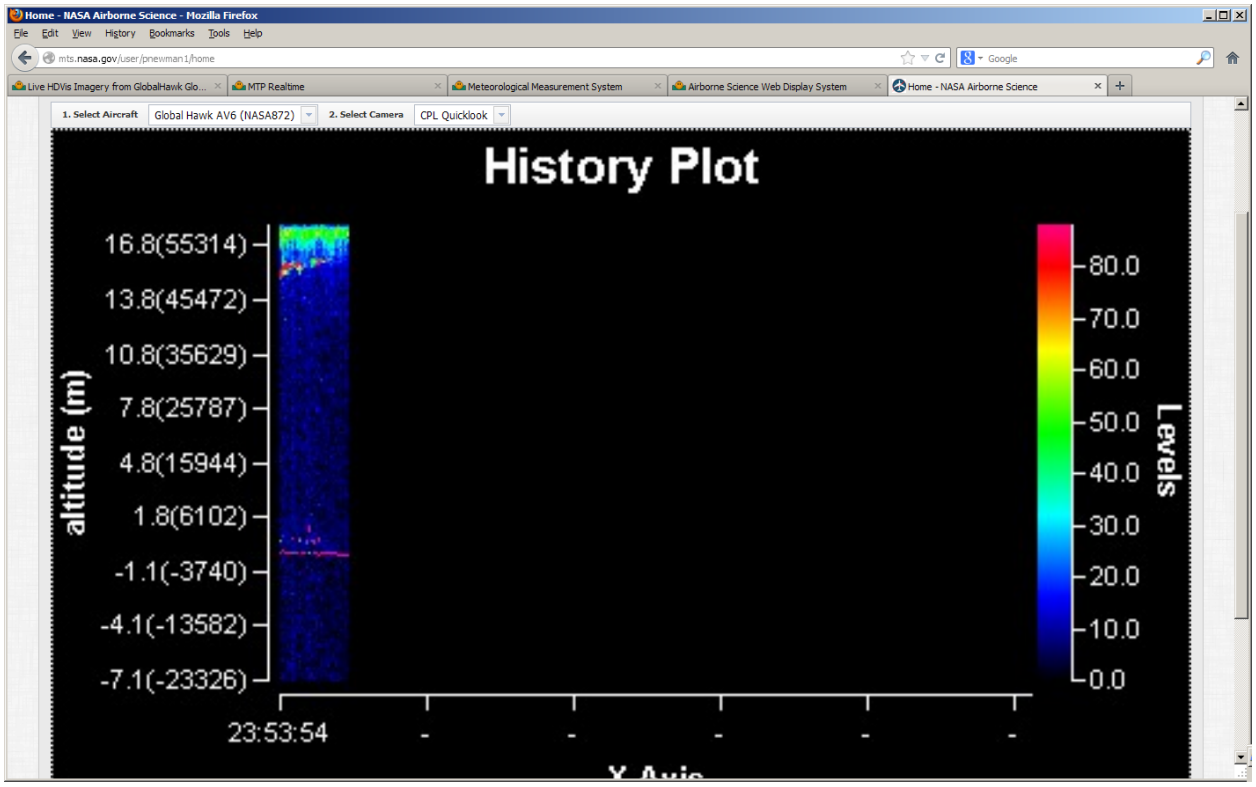
0014 Suggested to mission that we save the 40 minute cold period. Since we are above the cold point, have suggested descent when cold for 10 minutes.

0036 CPL has not seen clouds since about 4N, but solid band of clouds from 4N to 6N between about 15 and 17 km.

0045 Discussed with mission that we do not want to go above 60 kft before reaching W04.

Suggested going between 50 and 59 kft. Also indicated that this is likely to be the levels we want to use to profile the clouds on the way back to W03.

0052 Nice history plot from CPL of the cloud layer we saw between about 4N to 6N .



0057 Iridium communication has been flaky for the last 5-10 minutes. Not getting MTP or CPL updates.

0102 Iridium back up.

0105 Crossed the Equator.

0107 MTP hasn't updated since 0051, but data has seen packets. Checking into it.

0108 MTP getting data again.

0142 Been having Iridium communication problems for the last 10-15 minutes.

0155 ejensen takes over for cbardeen.

0223 No clouds apparent in CPL profiles south of about 3.8 N.

0255 Cloud apparent at 14 km near farpoint. Too low for us to sample.

0300 Turnaround at 10 S.

0305 Descending to 48 kft.

0316 EC23 fault caused a C2. Go to command issued to get us back on track.

0324 Climbing back up to 58 kft.

0352 Descending back down.

0356 Went through another small patch of T<-94 F. No chance for a 40-min exposure.

0359 ECY24 fault hit on descent. Deployed spoilers to accelerate descent.

0400 Climbing back up from 48 to 58 kft.

0421 Water vapor minimum in ascents and descents (and at cruise altitude on trip south) was about 2 ppmv.

0432 Descending back down from 58 to 48 kft.

0438 Spoilers deployed to accelerate descent from 53.7 kft.

0440 Climbing back up from 48 kft.

0450 Slight detection of ice in NOAA water at 53 kft.

0455 Sharp cold point < -94 F. Sharp drop in H2O at same location.

0520 Descending from 59 kft.

0529 ECS fault again. Climbing this time.

0533 Descending again.

0537 ECS fault again. Climbing.

0544 Back down we go from 58.4 kft.

0550 Spoilers opened to accelerate descent.

0551 Climbing from 48 kft.

0609 Dry layer at about 56 kft (at cold point).

0620-0630 descent from 58Kft begins; failure at 53.7Kft ECS fault (TT3 temp), climb cold air below us; descent again to 48 Kft (fault disappeared); failure again at 51 Kft climb back up-not in our control

0645 Ku up at 10 N; climb to 58Kfft then descend (fault again) to 48Kft

0715 climbing to 58Kft (no CPL people here or else would stay at 58Kft for some time)

0738 from 58 start descent to 48 kft; rapid descent fault at 51kft

0740 No attendant from CPL or MTP but MTP running

0810 at 58kft start descent (up-down spiral to about 20N). Not too many features. Missing CPL. At 52Kft fault again and fast descent

0835 descent from 58kft-18.2N; ECS fault (TT3) at 52Kft-fast descent.

0905 At 58K; Ascend and go above 60Kft heading home from 20N; Water vapor 2 ppm

0915 instruments all good except GWAS, no-CO channel on Harvard PICCARO

0950 At 62Kft, mostly low clouds only. Temp 195K at cold point (55Kft); O3-approx. 850 ppb

1100 Will plan to descend to 45Kft for 40 min. PV features to sample.

1125 At 45Kft. Power up is taking long time (15 min) (no CPL no MTP)

1140 At 45 Kft; O3-500 ppb; H2O-4 ppm (MTP back up)

1215 45 K; looks like strat air ; will stay here for a while then climb to 58K near range.

No high clouds. Irridium and Ku have worked good; we have deviated from the original plan to come to range at 45Kft, climb to 58Kft, then descend to 45 K ft for MMS (instruments are already warm). Short time at 45Kft then land.

1250 at 45Kft we seem to be in an O3 fold with O3~1 ppm

1335 start climb from 45 to 58 Kft in range. O3 near 2.4 ppm at 58Kft

1401 MMS maneuver begins at 44Kft

1504 Vehicle landed